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CANON PELLIANUS

sive

TABULA

simplicissimam aequationis
celebratissimae :

$$y^2 = ax^2 + 1$$

solutionem, pro singulis numeri
dati valoribus

AB 1 USQUE AD 1000,

in numeris rationalibus iisdemque integris exhibens,

A U T O R E

Carolo Ferdinando Degen,

DR. PHILOS. ET IN UNIV. REG. HAVNIENSI MATH. PROF. P. O. REG. SOC. SC. ET SÖS.
SCANDINAV. SODALI.

Est data Lex numeris magnorum horrenda laborum.

METAM. V. 8.



H A F N I A E.

Apud Gerhardum Bonnierum.

MDCCLXVII.

Consideratio numerorum quamvis plerisque omni usu
carere videatur, tamen per se non solum admodum est ju-
cunda, sed etiam animum ad veritatis indagacionem non me-
diocriter acuit eiusque vires magis intendit. Maxime enim
abundat doctrina numerorum veritatibus abstrusissimis, qua-
rum investigatio tantam ingenii penetrationem postulat,
ut nunquam cuncta, quæ involvit, mysteria erui et ex-
plicari posse videantur.

Nov. Comment. Petrop. Tom. IX, pag. 5.

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VIRIS

DOCTRINAE ET HUMANITATIS LAUDE

ORNATISSIMIS

IIIDEMQUE COLLEGIS

IN PROFESSIONE MATHEMATICA

CONJUNCTISSIMIS,

JACOBO WOLFIO

THEM. PROF. P. ORD. S. R. M. A CONSILII STATUS ET ORDINIS DANNEBROGICI
EQUITI AURATO;

ENRICO CHRISTIANO SCHUMACHER

J. U. DR. ET ASTRONOMIAE PROF. P. ORD.;

ERASMO GEORGIO FOG THUNE

DR. PHILOS. ET MATH. IN UNIV. HAVN. LECTORI.

Tertium jam volvente anno sæculari
Patriæ maxime memorabili,
almæque Universitati Hayniensi festissim
pium & fraternum animum testaturus,
volumine brevem, calculi labore prolixam
hanc opellam,
ea qua par est verecundia & observantia,
offert, dicat atque consecrat

Autor.

INTRODUCTIO.

Quemadmodum immensam Universi molem
dispertitam conspicimus ut minores massæ
hanc legem sequatur, non usque chaotice
portiones majoribus quibusdam sese
ingere hasque ceu sociæ comitari [clandestine
quasi vi propellente] cogantur: ita in intellectuali
scientiæ mathematicæ mundo videmus
immensum combinationum numerum
circa certas quasdam formas, hoc ipso præter
conspicuas & memorabiles, versari &
circa easdem quasi polos gyrari. Est adeo,
in coelo polorum, ita in mathesi harum
formarum investigatio atque determinatio res
maximi momenti. Quis nescit quantum in
diversa sublimiori artis regione notissimis

formis $e^{\pm x}$, $e^{\pm y\sqrt{-1}}$ tribuendum sit? quæ
ingens problematum difficillimorum numero
recto earum usu expediatur felicissime? Et
quem fugerit quam insigne calculorum com-
pendium contulerit utilissima illa functio
quæ Logarithmi nomine veniat? alias simile
ut taceamus.

Neque tamen ejusmodi functionibus
formis tribuenda est utilitas omnibus numeri
absoluta, nisi, cum sæpius occurrant, quæ
sæpius denuo computanda forent, semel com-
putentur & computata in Tabulas commodè
redigantur. Operæ igitur pretium me fecisse
credo, quod numericam celebratissimam
Æquationis Pellianæ solutionem, ad quam
quippe redeant pleræque solutiones proble-
matum diophanteorum secundi gradus, pro
millenis valoribus numeri cogniti susceperim
atque in præsentī Tabula exhibuerim, de cuius
usu atque constructione perpauca in medium
allaturus sum, cum uberior theoriæ, cui su-
perstructa est, expositio in scriptis virorum
immortalium EULERI, LAGRANGE, LEGENDRE a-
que τῷ πανὶ GAUSSII quæri debeat.

I.

uomodo ad æquationem Pellianam ducant
indeterminata quæ dicuntur problemata
secundi ordinis.

Proposita æquatione:

$$Ay^2 + Bxy + Cx^2 + Dy + Ex + F = 0,$$

eadem ad formam simpliciore reducat, ponamus

$ty + Bx + D = t$, cuius quadratum

$$4A^2y^2 + 4ABxy + B^2x^2 + 4ADy + 2BDx + D^2 = t^2$$

æquatione data, per $4A$ multiplicata, minuatur, residuam
rebebit æquationem:

$$t^2 = (B^2 - 4AC)x^2 + 2(BD - 2AE)x + D^2 - 4AF$$

$$\text{e } t^2 = Lx^2 + 2Mx + N$$

sito, brevitatis ergo,

$$L = B^2 - 4AC, M = BD - 2AE \text{ \& } N = D^2 - 4AF.$$

constat autem valorem ipsius t rationalem reddi posse

1) si fuerit aut L aut N numero quadrato æqualis;

2) si fuerit $M^2 - LN =$ numero quadrato; id est, si

$t^2 + 2Mx + N$ in factores rationales solvi posse depre-

ndatur.

Sit primo $L = G^2$ & $t = Gx + u$, erit t^2

$$G^2x^2 + 2Gxu + u^2 = G^2x^2 + 2Mx + N$$

$$\text{e } x = \frac{N - u^2}{2(Gu - M)} = \frac{u^2 - N}{2[M - Gu]}.$$

Ut hinc pro x & t valores integri eliciantur, spec-
da est indoles numerorum G, M, N . Scilicet si fuerit

$$1) \ u = \frac{M \pm 1}{G} = \text{numero integro} \ \& \ 2) \ N - u^2$$

$u^2 - N = \text{numero pari, radix } x \text{ in numeris integris semper obtinebitur. Deinde vero etiam requiritur ut sit } y = \frac{Gx + u - (Bx + D)}{2A} = \frac{(G - B)x + u - D}{2A} = \text{intero.}$

Compluribus igitur conditionibus premitur primus ille casus, quo $L = G^2$ statuitur. Neque id mirandum cum dentur expressiones hac $G^2x^2 + 2Mx + N$ multo simpliciores, quæ omnem solutionem in numeris integris irritam reddant. Videamus jam quidnam ex hypothesi secunda: $N = H^2$ sequatur.

Posito $t = H + ux$, erit $t^2 = Lx^2 + 2Mx + H^2 = H^2 + 2Hux + u^2x^2$ sive $Lx + 2M = 2Hu + u^2x$ sive $x = \frac{2(M - Hu)}{u^2 - L}$, quæ expressio, posito $u = \frac{w}{v}$ abit in $x = \frac{2(Mv - Hw)v}{w^2 - Lv^2}$. Quodsi jam apud nos fuerit ut denominator fiat unitati æqualis, sive ut pro dato quovis numero integro L obtineri queant numeri integri w & v æquationem $w^2 = Lv^2 + 1$, (ipsi, quam *Pellianam* dicimus) satisfaciētes, habebitur

$$1) \ x = 2(Mv - Hw)v \ \&$$

$$2) \ \pm t = H + 2(Mv - Hw)w$$

Hos autem ipsarum w & v valores, si numerus $L = B^2 - 4AC$ millenarium non excesserit, jam computatos exhibet Tabula nostra. Ita si quæritur valor ipsius x integer æquationi $t^2 = 539x^2 + 174x + 27556$ satisfactorus, ob $N = 166^2$ erit $H = 166$ & $L = 539$. Postremo huic numero respondent in Tabula valores $v = 171$ & $w = 3970$

are cum sit $M = 87$ habebitur $x = 2$. $[87.171 - 166.170].171 = -110148453.2 = -220296906$, cui vari respondet $t = \pm 5114495254$, quos, cum valores w & in Tabula exhibiti sint *minimi*, simul esse minimos facile respicitur.

Consideremus nunc casum, quo $M^2 - LN = K^2$. Hoc obtinente, reperietur $t^2 = (Lx + M + K) \left(x + \frac{M-K}{L}\right) = (Lx + M - K) \left(x + \frac{M+K}{L}\right)$.

Ponimus autem L, M & N esse integros; ergo et K sit integer; quare si L fuerit numerus primus, evidens est t $M + K$ aut $M - K$ per L esse dividuum, quoniam $(M+K)(M-K) = M^2 - K^2 = L.N$; adeoque in genere statuere licet $Lx^2 + 2Mx + N = t^2 = (Lx + G) + H$, unde posito $t^2 = \frac{w^2}{v^2} \cdot (x + H)^2$ fit $Lx + G = (x + H)$ sive $x = \frac{Hw^2 - Gv^2}{Lv^2 - w^2} = \frac{Gv^2 - Hw^2}{w^2 - Lv^2}$. Sic item ad æquationem Pellianam deducimur. Quapropter, in ejus solutio pro quovis numero L integro in potestate, et exc. exc. e Tabula depromi possit, habebimus, ut $w^2 = Lv^2 + 1$,

$x = Gv^2 - Hw^2$, atque $x + H = Gv^2 - H(w^2 - 1) = Gv^2 - LHv^2$ ideoque $t = wv \cdot [G - LH]$. obtinebitur igitur etiam hoc casu, dummodo numerus L fuerit minimus, valor radicis x in numeris integris.

Præter casus hic indicatos illum adhuc contemplabimur, quo, cognita solutione particulari æquationis generalissimæ

$$Ay^2 + Bxy + Cx^2 + Dy + Ex + F = 0,$$

scilicet $x=f$ & $y=g$, novas et numero infinitas ex eadem solutiones deduci posse monstrabimus. Hunc in finem statuamus novos istos valores fore $x'=x+\Delta x$ & $y'=y+\Delta y$. Tum sumendis more solito differentiis, prodibit

$$\Delta(x^2) = 2x\Delta x + \Delta x^2; \Delta(xy) = x\Delta y + y\Delta x - \Delta x\Delta y; \Delta(y^2) = 2y\Delta y + \Delta y^2.$$

Ut adeo solutiones $x, y; x', y'$; simul obtineant, necessarium est, differentiam æquationis propositæ itidem evanescere prout ipsa ad nihilum reducta repræsentatur. Hinc habetur

$$2Ay\Delta y + A\Delta y^2 + Bx\Delta y + By\Delta x + B\Delta x\Delta y - 2Cx\Delta x + C\Delta x^2 + D\Delta y + E\Delta x = 0$$

Faciamus jam, quod semper licebit, $\Delta x = pz$ & $\Delta y = -qz$, & erit, introducendis valoribus cognitis $f=x$ & $g=y$, facta divisione per z ,

$$-2Agq + Aq^2z - Bfq + Bgp - Bpqz + 2Cfz + Cp^2z - Dq + Ep = 0$$

$$\text{unde hauritur } z = \frac{(2Ag + Bf + D)q - (2Cf + Bg + E)p}{Aq^2 - Bpq + Cp^2}$$

$$\begin{aligned} &\text{Investigemus jam, quibus in casibus fieri possit } Aq^2 - Bpq + Cp^2 = 1, \text{ sive } q = \frac{Bp \pm \sqrt{(BB - 4AC)p^2 + 4A}}{2A} \\ &= \frac{Bp \pm \sqrt{Lp^2 + 4A}}{2A} \end{aligned}$$

$$\text{Cum hæc expressio, facto } p = 2r, \text{ abeat in sequentem: } q = \frac{Br \pm \sqrt{Lr^2 + A}}{A}$$

evidens est, casu $A=1$, novas solutiones in numeris integeris semper & nullo quidem negotio posse obtineri, quæ

do in Canone nostro numerum s eiusmodi, ut sit
 $= Lr^2 + 1$; tum enim

$q = Br \pm s$ & $p = 2r$, reperietur

$z = \pm (2Ag + Bf + D) Br \mp (2Ag + Bf + D)s$
 $\pm (2Cf + Bg + E). 2r$

$x' = f + pz = f \pm 2rz$, $y' = g - qz = g \mp Brz \mp sz$

in tam r quam s positive & negative sumere licebit. Tri-
 ex membri signum indicat, idem plane arbitrium ma-
 re, cum contra plura signa duplicia, prout adhiberi so-
 nit, relatione signi superioris & inferioris inter se con-
 ctantur.

Si vero acciderit ut valor ipsius A ab unitate differat,
 meri quos in Tabula *Legi Periodi* subiecimus, non so-
 n istos numeri A valores monstrabunt, pro quibus solu-
 possit obtineri, sed & ipsam solutionem suppeditabunt.
 si fuerit $L = 539$ & $A = +1, -10, +25, -19, +22$,
 utionem æquationis $539r^2 + A = \text{numero quadrato}$ &
legro: reperire licebit, methodo mox tradenda. Sic pro
 $= 22$ habebitur, ope Legis periodi, $r = 9$ & $\sqrt{539r^2 + 22}$
 $= 209$. Ut vèro etiam q fiat integer, necesse est sit (casu
 empli hic assumti) $9B \pm 209$ per 22 divisibilis, id quod
 redit, ut sit B impar & per 11 divisibilis; quare, nisi
 erit $A = 1$, pro generali hac eademque simplicissima
 nditione, aliæ æque diversissimæ indolis introducentur,
 ibus coëfficientes B & C adstringantur. His tamen id
 lum innuimus, quod *immediata* quam dicunt solutionis

$$\text{æquationis } Aq^2 - Bpq + Cp^2 = 1$$

æquationem Pellianam *reductio* valorem $A = 1$ suppo-
 nit. Etenim & universalem eadem illa æquatio solutionem

recipit. De gravissimo hoc argumento pro more suo (eleganter & perspicue) præcepit Illustr. *Legendre* in eximio illo Tractatu (*Theorie des Nombres*) Ed. 2. pag. 93-96.

II.

De subsidio e fractionum continuarum evolutione ad æquationis Pellianæ solutionem petendo.

Proposita æquatione $y^2 = ax^2 + 1$ per numeros integros solvenda sufficiet unicam solutionem investigasse hac enim inventa, puta $x = f$ & $y = g$, novus valor reperietur

$$\text{ipsius } x; \quad x' = 2fg$$

$$\text{ipsius } y; \quad y' = 2g^2 - 1$$

Etenim, ob $g^2 - 1 = af^2$ erit

$$4g^4 - 4g^2 = 4af^2g^2 \text{ atque}$$

$$4g^4 - 4g^2 + 1 = 4af^2g^2 + 1 \text{ sive}$$

$$(2g^2 - 1)^2 = a \cdot (2fg)^2 + 1$$

Novi adeo valores, & quidem, ubi de numeris integris agitur, inventis majores, erunt $x' = 2fg$ & $y' = 2g^2 - 1$

Inventis autem ξ & η æquationi $\eta^2 = a\xi^2 - 1$ satisfaciuntibus, habetur $x = 2\xi\eta$ & $y = 2\eta^2 + 1$; nam

ob $\eta^2 + 1 = a\xi^2$ erit $4\eta^4 + 4\eta^2 = 4a\eta^2\xi^2$, unde, ut ante reperitur $(2\eta^2 + 1)^2 = a \cdot (2\xi\eta)^2 + 1$ sive $y^2 = ax^2 + 1$.

Etsi autem in genere satisfaciant valores $x = 0$ & $= 1$, tamen hinc nihil novi reperietur. Aliam igitur in ingressi sunt Analystæ. Observarunt problematis solutionem a radice quadrata numeri cogniti (a) pendere, in utriusque fractionis $\frac{\gamma}{x}$ & $\frac{\eta}{\xi}$ valor sit radici \sqrt{a} quam proximis. Ponamus igitur, ut determinatus ipsius a valet et universi calculi ratio menti obversetur & memoriæ hæreat, quærendam esse radicem numeri 209, quam novimus esse > 14 & < 15 , & indicemus eandem brevitatis causa littera R , ita ut sit $R^2 = 209$. His stabilitis patet esse $R = 14 + \frac{1}{x}$ & $x > 1$.

$$\text{are cum } \alpha = \frac{1}{R-14} = \frac{R+14}{209-14^2} = \frac{R+14}{13} = 2 + \frac{1}{\beta}$$

$$\text{erit } \beta = \frac{13}{R-12} = \frac{13(R+12)}{209-12^2} = \frac{R+12}{5} = 5 + \frac{1}{\gamma}$$

$$- \gamma = \frac{5}{R-13} = \frac{5(R+13)}{209-13^2} = \frac{R+13}{8} = 3 + \frac{1}{\delta}$$

$$- \delta = \frac{8}{R-11} = \frac{8(R+11)}{209-11^2} = \frac{R+11}{11} = 2 + \frac{1}{\varepsilon}$$

$$- \varepsilon = \frac{11}{R-11} = \frac{11(R+11)}{209-11^2} = \frac{R+11}{8} = 3 + \frac{1}{\zeta}$$

$$- \zeta = \frac{8}{R-13} = \frac{8(R+13)}{209-13^2} = \frac{R+13}{5} = 5 + \frac{1}{\eta}$$

$$- \eta = \frac{5}{R-12} = \frac{5(R+12)}{209-12^2} = \frac{R+12}{13} = 2 + \frac{1}{\theta}$$

$$- \theta = \frac{13}{R-14} = \frac{13(R+14)}{209-14^2} = \frac{R+14}{1} = 28 + \frac{1}{\alpha}; \text{ergo}$$

$$\alpha = \frac{1}{R-14} = \frac{R+14}{209-14^2} = \frac{R+14}{13} = 2 + \frac{1}{\beta}$$

& ita porro.

Videmus hic, cum perventum fuerit ad numerum δ , cui pars integra est $= 2$, partes integras sequentium numerorum ϵ , ζ , η , ordine retrogrado procedere, partibus nimirum integris numerorum γ , β , α æquales; deinde, introductum numerum θ , cuius pars integra æqualis sit duplo radiceis in numeris integris proximæ. Totus autem hicce calculus insignem in modum contrahetur sequenti schemate conficiendo:

		C	D C		E		
$\overline{14}$	$\overline{A} \quad \overline{B}$		Quotus e divisione	est	\overline{B}	\overline{C}	$\overline{14}$
$209 - 14^2 = 1 \cdot 13$		2	$(14 + 14) : 13$	2	$13 \cdot 2 - 14 = 12$		
$209 - 12^2 = 13 \cdot 5$		5	$(14 + 12) : 5$	5	$5 \cdot 5 - 12 = 13$		
$209 - 13^2 = 5 \cdot 8$		3	$(14 + 13) : 8$	3	$8 \cdot 3 - 13 = 11$		
$209 - 11^2 = 8 \cdot 11$		2	$(14 + 11) : 11$	2	$11 \cdot 2 - 11 = 11$		
$209 - 11^2 = 11 \cdot 8$		3	$(14 + 11) : 8$	3	$8 \cdot 3 - 11 = 13$		
$209 - 13^2 = 8 \cdot 5$		5	$(14 + 13) : 5$	5	$5 \cdot 5 - 13 = 12$		
$209 - 12^2 = 5 \cdot 13$		2	$(14 + 12) : 13$	2	$13 \cdot 2 - 12 = 14$		
$209 - 14^2 = 13 \cdot 1$		28	$(14 + 14) : 1$	28			
&c.			&c.				&c.

Originem numerorum sub C ponendorum indicat Col. D , illorum vero qui sub A (& B) reperiuntur (atque *initio* tantum, non *ordine* differunt) explicat Col. E . Horum numerorum priores prima, posteriores secunda series in Tabula numero cuiusvis dato a (hic 209) adscripta exhibet, a *medium*, unde nempe incipit retrogradus ille ordo, tantummodo continuata, quem adeo, ut distinguatur a reliquis, uncinulis inclusimus. Pro certis nimirum ipsius a valoribus, quos in *Appendicem* s. Tab. 2. retulimus, evenit,

ius ille terminus bis occurrat, id quod indicat valores y , methodo jam tradenda reperiundos, non æquationi $= ax^2 + 1$ sed alteri $y^2 = ax^2 - 1$ convenire, cuius lem solutionem numericam ut in Tab. II. seorsim ex-
erem fuere plures quæ me suaderent rationes, præser-
uniformitatis servandæ studium.

Inventa, modo ante insignito, radice

$$\sqrt{209} = 14 + \frac{1}{2 + \frac{1}{5 + \frac{1}{3 + \frac{1}{2 + \&c.}}}}$$

ores ad ipsam magis magisque appropinquantes facile re-
iuntur ope diagrammatis Lambertiani, sequentem in
dum conficiendi:

[$a = 209$]

$A C$		$\frac{x}{y}$
		1 0
- 1	14.....	0 1
- 13	2.....	1 14
- 5	5.....	2 29
- 8	3.....	11 159
- 11	(2).....	35 506
- 8	3.....	81 1171
- 5	5.....	278 4019
- 13	2.....	1471 21266
+ 1	28.....	3220 46551

Productum cuiuslibet x
aut y , per numerum sub C
e regione positum, si proxi-
me præcedenti x aut y ad-
datur, præbebit valorem
sequentis x aut y .

Ita est $278 = 3 \cdot 81 + 35$
& $4019 = 3 \cdot 1171 + 506$.
item: $3220 = 2 \cdot 1471 + 278$
& $46551 = 2 \cdot 21266 + 4019$
& sic de reliquis.

Numeri Columnæ A , quos nota generali $\pm n$ denotabo, ita cum valoribus x & y cohærere deprehenduntur ut semper sit $ax^2 \pm n = y^2$ sive $y^2 - ax^2 \mp n = 0$. Huius æquationis solutio, adhibendo signum adscripto contrarium, ex evolutione fractionis continuæ ope diagrammaticè hic delineati, nullo negotio innotescet. Ita si quæras, quibusnam valores ipsarum x & y æquationi $y^2 - 209x^2 - 5 = 0$ satisfaciant, e regione $\tau\tilde{g} n = 5$ (Col. A) reperies confirmatim geminam solutionem:

$$\text{scil. } x = 2 \text{ \& } y = 29 ; \quad x = 278 \text{ \& } y = 4019.$$

Numeri autem autem $x = 3220$ & $y = 46551$, e regione $\tau\tilde{g} n = 1$ sunt ipsæ radices æquationis Pellianæ, iidemque quos ad $a = 209$ Tabulæ insertos reperies.

Casum, quo medius ille terminus bis occurrat, habebis sequenti exemplo:

$\tau\tilde{g}$	A	B	C		A	C	$[a=173]$	x	y
$173 - 13^2 = 1 \cdot 4$		4	6					1	0
$173 - 11^2 = 4 \cdot 13$		13	[1]		+	1	13	0	1
$173 - 2^2 = 13 \cdot 13$		13	[1]		-	4	6	1	13
$173 - 11^2 = 13 \cdot 4$		4	6		+	13	1	6	79
$173 - 13^2 = 4 \cdot 1$		1	26		-	13	1	7	82
&c.			&c.		+	4	6	13	171
					-	1	26	85	1118

Ob terminos medios 1 (Col. C) & 13 (Col. A) repetitos evidens est, signa in posteriori periodi dimidio illis opposita fore, quæ prioris dimidii æqualibus & a mediis illis æqu

antibus numeris respondeant. Quare nunc in potestate
tra erunt solutiones æquationum

$$x^2 - 173x^2 + 1 = 0; y^2 - 173x^2 + 4 = 0; y^2 - 173x^2 + 13 = 0.$$

t ergo $y^2 - 173x^2 + 1 = 0$ si fuerit $x = 85$ & $y = 1118$,
que valores in Appendicem Tabulæ contulimus. Ut
o hinc eliciantur radices æquationis $y^2 - 173x^2 - 1 = 0$,
i debet $x = 2.85.1118 = 190060$ & $y = 2.1118^2 + 1$
2499849, uti easdem radices exhibet Tabula nostra.

III.

*nonnullis artificiis, quibus facilior red-
ditur Canonis hujusmodi constructio.*

Jamdudum observarunt acutissimi harum rerum in-
gigatores, pro numeris a certæ formæ, v. c. $a = p^2 \pm 1$
 $a = p^2 \pm 2$, radices x & y in promptu esse. Fiat scilicet

pro $a = p^2 \pm 1$, $x = 2p$ et erit $y = 2p^2 \pm 1$

pro $a = p^2 \pm 2$, $x = p$ $y = p^2 \pm 1$.

1: pro $a = p^2 \pm p$, $x = 2$ $y = 2p \pm 1$

quibus casibus addere licet generaliores hosce:

pro $a = n^2 p^2 \pm n$ fiat $x = 2p$ et erit $y = 2np^2 \pm 1$

pro $a = n^2 p^2 \pm 2n$ $x = p$ $y = np^2 \pm 1$

sumtis pro n & p numeris quibuslibet integris.

Deinde observandum est, quoties $a = aq^2$, ipsique
 $a\xi^2 + 1 = \eta^2$ respondeat radix ξ aut η per q divisibilis, tu
 fore $x = \frac{\xi}{q}$ & $y = \eta$, casu quo ξ ; sed $x = \frac{2\xi\eta}{q}$ & $y = 2$
 — 1 casu quo η per q dividi posse deprehenderis.

Ita cum $\tau\tilde{\omega} a = 84$ respondeat $\xi = 6$ & $\eta = 5$
 manente $y = 55$, patet

$$\text{ipsi } a = 2^2 \cdot 84 = 336 \text{ respondere } x = \frac{6}{2} = 3$$

$$\text{..... } a = 3^2 \cdot 84 = 756 \text{ } x = \frac{6}{3} = 2$$

$$\text{..... } a = 6^2 \cdot 84 = 3024 \text{ } x = \frac{6}{6} = 1.$$

$$\text{Item manente } y = 2\eta^2 - 1 = 2 \cdot 55^2 - 1 = 6049$$

$$\text{ipsi } a = 5^2 \cdot 84 = 2100 \text{ respondebit } x = \frac{2 \cdot 6 \cdot 55}{5} = 132$$

$$\text{..... } a = 11^2 \cdot 84 = 10164 \text{ } x = \frac{2 \cdot 6 \cdot 55}{11} = 60$$

Nemo autem, quod equidem sciam, animadvertit
 numeros a formæ $(2p + 1)^2 \pm 4$ solutionem generalem,
 fractionum continuarum evolutione minime penderet
 admittere. Quare analyseos diophantæe amatoribus hanc
 ingratum fore spero, si geminum huc spectans theorema
 prætermissa demonstratione, quam quilibet huius artis po-
 ritus, synthetice saltem, facillime ipse sibi concinnabit
 in præsentī commentariolo, ceu loco huic argumento max-
 ime idoneo, cum iisdem communicavero.

THEOREMA I.

$$\text{Si fuerit } a = (2p + 1)^2 - 4 = 4p^2 + 4p - 3 \\ = (2p + 3)(2p - 1)$$

$$\text{erunt radices æquationis } y^2 - ax^2 - 1 = 0$$

$$x = 2p(p + 1) \text{ \& } y = (2p + 1)(2p^2 + 2p - 1)$$

THEOREMA 2.

Si fuerit $a = (2p + 1)^2 + 4 = 4p^2 + 4p + 5$
 $4(p^2 + p + 1) + 1$

erit $x = 4(2p + 1)(p^2 + p + 1)(2p^2 + 2p + 1)$

& $y = 8(2p + 1)^2 \cdot (p^2 + p + 1)^2 + 1$.

, si $p = 4$, habebimus pro $a = 9^2 - 4 = 77$,

valores $x = 8 \cdot 5 = 40$; $y = 9 \cdot 39 = 351$

pro a vero $= 9^2 + 4 = 85$, $x = 4 \cdot 9 \cdot 21 \cdot 41 = 30996$;

$y = 8 \cdot 9^2 \cdot 21^2 + 1 = 285769$

orem typothetæ, quo factum est ut Tabula, quam Il-
 tr. *Eulerus* Nov. Comm. Acad. Petrop. Tom. XI. pag. 64
 55 inseruit, ad $a = 85$ pro $x = 30996$, hunc valorem
 30906 exhibeat, ita corrigere licuit. Graviorum vero,
 i typothetæ sed ipsi auctori tribuendum, eiusdem Theore-
 tis 2^{di} beneficio deteximus et emendavimus, scil. ad
 $= 53 = 7^2 + 4$, ubi, ob $p = 3$, congruit quidem ipsius
 valor $= 4 \cdot 7 \cdot 13 \cdot 25 = 9100$, discrepat vero $y' = 33125$;
 quo scilicet scribi debet $y = 8 \cdot 7^2 \cdot 13^2 + 1 = 66249$
 $2y' - 1$.

Addimus hic methodum, cuius ope, post exhaustos
 us x valores, radicis y valor, æquationi Pellianæ satis-
 ens, facillime reperietur. Huius methodi ratio ex iis
 ime perspicietur quæ *Arithmetice universalis* Cap. 8^{vo}
 ridiana sane luce splendentia, de fractionibus continuis
 lidit sagacissimus KRAMP, non unius ille facultatis ana-
 cæ autor celeberrimus.

C	$\frac{xy}{-}$	
	1	0
R	0	1
a	1	R
β	a	$Ra+1$
γ	$\beta a+1$	$R(\beta a+1)+\beta$
δ	$\gamma\beta a+\gamma+a$	$R(\gamma\beta a+\gamma+a)+\gamma\beta+1$
ϵ ...	$\delta\gamma\beta a+\delta\gamma+\delta a+\beta a+1$	$R(\delta\gamma\beta a+\delta\gamma+\delta a+\beta a+1)+\delta\gamma\beta+\delta+1$
&c.		&c.

Præsentis nempe diagrammatis indolem propius inspiciendibus patebit, illud typum generalem methodi ante traditum referre. Valores hosce ipsarum x & y generales idonee *Mediatorum* nomine insignivit Vir Cl., commoda hanc notatione adhibita, ut elementorum a, β, γ, δ signis litteris majusculis, quas uncinulis inclusit, repræsententur. Ita

$$\begin{array}{lcl}
 \gamma = (\beta a + 1) \text{ per } (AB) \text{ aut } (BA) \\
 \delta = (\gamma\beta a + \gamma + a) \text{ per } (AC) \text{ aut } (CA) \\
 \epsilon = (\delta\gamma\beta a + \delta\gamma + \delta a + \beta a + 1) \text{ per } (AD) \text{ aut } (DA) \\
 \text{\&c.} & & \text{\&c.}
 \end{array}
 \left. \vphantom{\begin{array}{l} \gamma \\ \delta \\ \epsilon \end{array}} \right\} \begin{array}{l} \text{notatione com} \\ \text{moda \& diluc} \\ \text{da exhibentur} \end{array}$$

Ponamus jam elementa ipsi C subjecta casu dato n^{tum} usque (quod esto ν) procedere, ita ut series illa sit

$$R, \alpha, \beta, \gamma, \delta, \epsilon, \zeta, \dots \kappa, \lambda, \mu, \nu,$$

ob periodi symmetriam:

$$R, \alpha, \beta, \gamma, \delta, \epsilon, \zeta, \dots \delta, \gamma, \beta, \alpha;$$

ne post elementum ν sive α intrare terminum $2R$, cuius regione reperiuntur radices æquationis $y^2 = ax^2 \pm 1$; atque valoribus x & y in superiori diagrammate sibi respondentibus, perspicietur fore $y = Rx + (BN) = Rx + (MA)$ non differunt enim β & μ , ν & α] $= Rx + (AM)$.

Est scilicet semper $(MA) = (AM)$; & cum manifestum sit $x = (AN)$, erit (AM) mediator ipsum (AN) , id est ipsam x proxime præcedens. Posito igitur præcedente valore $= x_1$ erit $y = Rx + x_1$.

Ita, ut exemplum aliquod prolixioris calculi affertur, sit $a = 739$, pro quo numero Tabula nostra exhibet gem periodi:

$$7, 5, 2, 2, 1, 1, 3, 3, 2, 1, 8, 2, 1, 2, 1, 17, 2, 1, 1, 7, 5, 1, 10, (27)$$

missis igitur superfluis diagrammatis lineis, erit calculi x instituendi typus:

$\alpha = 739$

1	(5)
5	(2)
11	(2)
27	(1)
38	(1)
65	(3)
233	(3)
764	(2)
1761	(1)
2525	(8)
21961	(2)
46447	(1)
68408	(2)
183263	(1)
251671	(17)
4461670	(2)
9175011	(1)
13636681	(1)
22811692	(7)
173318525	(5)
889404317	(1)
1062722842	(10)
11516632737	(27)
312011806741	(10)
3131634700147	(1)
3413646506888	(5)
20349867234587	(7)
145892717148997	(1)
166242584383584	(1)
312135301532581	(2)
790513187448746	(17)
13750859488161263	(1)
14541372675610009	(2)
42833604839381281	(1)
57374977514991290	(2)
157583559869363861	(8)
1318043456469902178	(1)
1475627016339266039	(2)
4269297489148434256	(3)
14283519483784568807	(3)
47119855940502140677	(1)
61403375424286709484	(1)
108523231364788850161	(2)
278449838153864409806	(2)
Ergo $x_1 =$ 655422907672517669773	(5)

$$\& x = 3605564376516452758671 \quad (28)$$

$$\text{Jam ob } R = 27$$

$$\text{reperietur } Rx = 97350238165944224484117$$

$$\text{cui si add. } x_1 = 665422907672517669773$$

$$\text{prodibit } y = 98015661073616742153890$$

etque tamen hoc compendio usi sumus ad valores radicis y imputandos, sed idem potius ceu lapidem lydium adhibuimus, quo explorare possemus, utrum recte se haberent valores x & y , eadem via seorsim inventi. Cum enim tanta numerorum mole, quantam sæpissime majores numeri a valores excient, nimis facile præstringatur oculorum acies, a vero etiam facile aberrabitur in valore ipsius computando, quali, si determinationem radicis y superuxeris temere, utramque radicem falsam habebis; contra, utramque radicem seorsim computando et ad normam præscriptam comparando, ut numeros ex obrussa tutos obtineamus, certis esse liceat. Insignem huius cunctitudinis partem lubentes & grati fatemur nos debere clementiæ & peritiæ Viri, mathematicæ analyseos amantissimi *Henrici Georgii a Smidten*, in exercitu S. R. M. jacitibus tormenta bellica succenturiatus præfectus, qui laudem complurium magnorum numerorum & computandorum & nobiscum examinandorum ut promptissimo animo, ita indefesso studio, suscepit atque absolvit.

Non possum quin, antequam huic præfatiunculæ finem faciam, *de singulari ea radicis x proprietate, qua sese factores solvi patitur, quantumvis magno demum numero exprimatur*, pauca in medium afferam. Ita si recondentem ipsi $a = 487$ radicem in Tabula nostra quærens, invenies $x = 2352088722477$ quæ in factores primos solubilis deprehendetur. Est scil. $x = 3.13.137.2383.84733$. Ratio est in propatulo. Cum sit $y^2 = ax^2 + 1$ sit $a = \frac{(y+1)(y-1)}{x \cdot x}$. Quare, cum a sit integer, erit

ipsi x aut cum $y + 1$ aut cum $y - 1$ communis aliquis divisor, quo reperto ad ulteriorem reliquorum factorum ipsius x munitam esse viam facile intelligitur.

Habes hic L.B. quæ circa nostri laboris indolem & rationem breviter præmonere necessarium nobis videbatur. Ut lætus eodem fruaris, ut temporis compendio ad abstrusissima numerorum mysteria Tibi aditum patefacias, tortuosos functionis hic amplius enucleatæ Mæandros ac visu perlustrans quæ alte lateant in apricum producas, denique ut, si humani quid acciderit, humanissime idem indicare atque corrigere velis, enixe atque verecunde spero rogo et obsecro.

- (a) Superfluum est de alio & ab instituto nostro prorsus alieno præsentis Tabulæ usu monere. Cum scilicet sit $y^2 = ax^2 \pm 1$, erit $\sqrt{a} = \frac{1}{x} \sqrt{y^2 \pm 1} = \frac{y}{x} \pm \frac{1}{2xy}$ quam proxime. Dabit ergo eadem radices quadratas ipsius a , quam proxime quoto $\frac{y}{x}$ æquale nec non, pro magnis ipsarum x & y valoribus, quatum $\frac{1}{2x}$ errorem accurate satis indicaturum.

TABULA I.

SOLUTIONEM AEQUATIONIS

$$y^2 - ax^2 - 1 = 0$$

EXHIBENS.

$$y^2 - ax^2 - 1 = 0$$

Then.

$$N \mid \alpha, \beta, \gamma (\beta).$$

means

$$N = \alpha + \frac{1}{\beta + \frac{1}{\gamma + \frac{1}{\beta + \frac{1}{\gamma + \frac{1}{\beta + \frac{1}{\alpha + N}}}}}}$$

$$N \mid \alpha, (\beta, \beta).$$

$$N = \alpha + \frac{1}{\beta + \frac{1}{\beta + \frac{1}{\alpha + N}}}$$

• satisfy $a^2 - Db^2 = 1$
 & write

$$a = \frac{\sqrt{a-1}}{2}, b = \frac{\beta}{2a} \text{ then } a, b$$

$$\text{satisfy } a^2 - Db^2 = 1$$

Which equation admits of other solutions
 when β is not a perfect square.

<p>1, (0) 1 0 0 1</p>	<p>1, (2) 1 1 2 3</p>	<p>1, (1) 1 2 3 1 2</p>
<p>2, (0) 1 0 0 1</p>	<p>2, (4) 1 1 4 9</p>	<p>2, (2) 1 2 6 2 5</p>
<p>2, 1, (1) 1 3 2 3 8</p>	<p>2, (1) 1 4 8 1 3</p>	<p>3, (0) 1 0 9 0 1</p>
<p>3, (6) 1 1 6 19</p>	<p>3, (3) 1 2 11 3 10</p>	<p>3, (2) 1 3 12 2 7</p>
<p>3, 1, (1, 1) 1 4 3 3 180 649</p>	<p>3, 1, (2) 1 5 2 14 4 15</p>	<p>3, (1) 1 6 15 1 4</p>
<p>4, (0) 1 0 0 1</p>	<p>4, (8) 1 1 17 8 33</p>	<p>4, (4) 1 2 18 4 17</p>
<p>4, 2, 1, (3) 1 3 5 2 39 170</p>	<p>4, (2) 1 4 20 2 9</p>	<p>4, 1, 1, (2) 1 5 4 3 21 12 55</p>
<p>4, 1, 2, (4) 1 6 3 2 42 197</p>	<p>4, 1, (3) 1 7 2 23 5 24</p>	<p>4, (1) 1 8 24 1 5</p>

$$\begin{aligned}
 (3 + \sqrt{5})^3 &= 8(9 + 4\sqrt{5}) \\
 (1 + 3\sqrt{3})^3 &= 8(649 + 180\sqrt{3}) \\
 (5 + \sqrt{21})^3 &= 8(55 + 12\sqrt{21})
 \end{aligned}$$

25	5, (0) 1 0 0 1	26	5, (10) 1 1 10 51	27	5, (5) 1 2 5 26
28	5, 3, (2) 1 3 4 24 127	29	5, 2, (1, 1) 1 4 (5 5) 1820 9801	30	5, (2) 1 5 2 11
31	5, 1, 1, 3, (5) 1 6 5 3 2 273 1520	32	5, 1, (1) 1 7 4 3 17	33	5, 1, (2) 1 8 3 4 23
34	5, 1, (4) 1 9 2 6 35	35	5, (1) 1 10 1 6	36	6, (0) 1 0 0 1
37	6, (12) 1 1 12 73	38	6, (6) 1 2 6 37	39	6, (4) 1 3 4 25
40	6, (3) 1 4 3 19	41	6, (2, 2) 1 (5 5) 320 2049	42	6, (2) 1 6 2 13
43	6, 1, 1, 3, 1, (5) 1 7 6 3 9 2 531 3482	44	6, 1, 1, 1, (2) 1 8 5 7 4 30 199	45	6, 1, 2, (2) 1 9 4 5 24 161
46	6, 1, 3, 1, 1, 2, (6) 1 10 3 7 6 5 2 3588 24335	47	6, 1, (5) 1 11 2 7 48	48	6, (1) 1 12 1 7

$$(27 + 5\sqrt{29})^3 = 8(9801 + 1820\sqrt{29}) \overset{25-48}{\substack{= 8(9801 + 1820\sqrt{29}) \\ = 8(9801 + 1820\sqrt{29}) \\ = 8(9801 + 1820\sqrt{29})}} = 8(9801 + 1820\sqrt{29})$$

49	7, (0) 1 0 0 1	50	7, (14) 1 1 14 99	51	7, (7) 1 2 7 50
52	7, 4, 1, (2) 1 3 9 4 90 649	53	7, 3, (1, 1) 1 4 (7 7) 9100 66249	54	7, 2, 1, (6) 1 5 9 2 66 485
55	7, 2, (2) 1 6 5 12 89	56	7, (2) 1 7 2 15	57	7, 1, 1, (4) 1 8 7 3 20 151
58	7, 1, 1, (1, 1) 1 9 6 (7 7) 2574 19603	59	7, 1, 2, (7) 1 10 5 2 69 530	60	7, 1, (2) 1 11 4 4 31
61	7, 1, 4, 3, 1, (2, 2) 1 12 3 4 9 (5 5) 226153980 1766319049	62	7, 1, (6) 1 13 2 8 63	63	7, (1) 1 14 1 8
64	8, (0) 1 0 0 1	65	8, (16) 1 1 16 129	66	8, (8) 1 2 8 65
67	8, 5, 2, 1, 1, (7) 1 3 6 7 9 2 5967 48842	68	8, (4) 1 4 4 33	69	8, 3, 3, 1, (4) 1 5 4 11 3 936 7775
70	8, 2, 1, (2) 1 6 9 5 30 251	71	8, 2, 2, 1, (7) 1 7 5 11 2 413 3480	72	8, (2) 1 8 2 17

73	8, 1, 1, (5, 5) 1 9 8 (3 3) 267000 2281249	74	8, 1, (1, 1) 1 10 (7 7) 430 3699
75	8, 1, (1) 1 11 6 3 26	76	8, 1, 2, 1, 1, 5, (4) 1 12 5 8 9 3 4 6630 57799
77	8, 1, 3, (2) 1 13 4 7 40 351	78	8, 1, (4) 1 14 3 6 53
79	8, 1, (7) 1 15 2 9 80	80	8, (1) 1 16 1 9
81	9, (0) 1 0 0 1	82	9, (18) 1 1 18 163
83	9, (9) 1 2 9 82	84	9, (6) 1 3 6 55
85	9, 4, (1, 1) 1 4 (9 9) 30996 285769	86	9, 3, 1, 1, 1, (8) 1 5 10 7 11 2 1122 10405
87	9, (3) 1 6 3 28	88	9, 2, 1, (1) 1 7 9 8 21 197

89	9, 2, (3, 3) 1 8 (5 5) 53000 500001	90	9, (2) 1 9 2 19
91	9, 1, 1, 5, (1) 1 10 9 3 14 165 1574	92	9, 1, 1, 2, (4) 1 11 8 7 4 120 1151
93	9, 1, 1, 1, 4, (6) 1 12 7 11 4 3 1260 12151	94	9, 1, 2, 3, 1, 1, 5, 1, (8) 1 13 6 5 9 10 3 15 2 221064 2143295
95	9, 1, (2) 1 14 5 4 39	96	9, 1, (3) 1 15 4 5 49
97	9, 1, 5, 1, 1, (1, 1) 1 16 3 11 8 (9 9) 6377352 62809633	98	9, 1, (8) 1 17 2 10 99
99	9, (1) 1 18 1 10	100	10, (0) 1 0 0 1
01	10, (20) 1 1 20 201	102	10, (10) 1 2 10 101
03	10, 6, 1, 2, 1, 1, (9) 1 3 13 6 9 11 2 22419 227528	104	10, (5) 1 4 5 51

105	IO, (4) I 5 4 41	106	IO, 3, 2, I, (I, I) I 6 7 IO (9 9) 3115890 32080051
107	IO, 2, I, (9) I 7 13 2 93 962	108	IO, 2, I, I, (4) I 8 9 II 4 130 1351
109	IO, 2, 3, I, 2, 4, I, (6, 6) I 9 5 12 7 4 15 (3 3) 15140424455100 158070671986249	110	IO, (2) I IO 2 21
111	IO, I, I, (6) I II IO 3 28 295	112	IO, I, I, (2) I 12 9 7 12 127
113	IO, I, I, I, (2, 2) I 13 8 II (7 7) 113296 1204353	114	IO, I, 2, (IO) I 14 7 2 96 1025
115	IO, I, 2, I, I, (I) I 15 6 II 9 IO 105 1126	116	IO, I, 3, 2, I, (4) I 16 5 7 13 4 910 9801
117	IO, I, 4, (2) I 17 4 9 60 649	118	IO, I, 6, 3, 2, (IO) I 18 3 6 9 2 28254 306917
119	IO, I, (9) I 19 2 11 120	120	IO, (I) I 20 1 11

21	II, (0) I 0 0 1	122	II, (22) I I 22 243
23	II, (II) I 2 11 122	124	II, 7, 2, I, I, I, 3, I, (4) I 5 8 II 9 12 15 15 4 414960 4620799
25	II, 5, (I, I) I 4 (II II) 83204 930249	126	II, 4, (2) I 5 9 40 449
27	II, 3, I, 2, 2, 7, (II) I 6 13 7 9 3 2 419775 4730624	128	II, 3, (5) I 7 4 51 577
29	II, 2, I, 3, I, (6) I 8 13 5 16 3 1484 16855	130	II, (2, 2) I (9 9) 570 6499
31	II, 2, 4, (II) I 10 5 2 927 10610	132	II, (2) I II 2 23
33	II, I, I, 7, 5, I, I, I, (2) I 12 II 3 4 13 9 12 7 224460 2588599	134	II, I, I, 2, I, 3, I, (10) I 13 10 7 14 5 17 2 12606 145925
35	II, I, I, I, (I) I 14 9 II 10 21 244	136	II, I, (I) I 15 8 3 35

137	II, I, 2, 2, (I, I) I 16 7 8 (II II) 519712 6083073	138	II, I, (2) I 17 6 4 47
139	II, I, 3, 1, 3, 7, I, I, 2 (II) I 18 5 15 6 3 13 10 9 2 6578829 77563250	140	II, I, (4) I 19 4 6 71
141	II, I, (6) I 20 3 8 95	142	II, I, (10) I 21 2 12 143
143	II, (I) I 22 1 12	144	12, (0) I 0 0 1
145	12, (24) I 1 24 289	146	12, (12) I 2 12 145
147	12, (8) I 3 8 97	148	12, (6) I 4 6 73
149	12, 4, I, 5, (3, 3) I 5 17 4 (7 7) 2113761020 25801741449	150	12, (4) I 6 4 49
151	12, 3, 2, 7, I, 3, 4, I, I, (II) I 7 10 3 17 6 5 14 9 15 2 140634693 1728148040	152	12, (3) I 8 3 37

53	<p>I2, 2, I, 2, (2) I 9 13 8 9 176 2177</p>	154	<p>I2, 2, 2, 3, I, (2) I 10 9 6 15 7 1716 21295</p>
55	<p>I2, 2, (4) I 11 5 20 249</p>	156	<p>I2, (2) I 12 2 25</p>
57	<p>I2, I, I, 7, I, 5, 2, I, (I, I) I 13 13 3 19 4 9 12 (II II) 3726964292220 46698728731849</p>	158	<p>I2, I, I, 3, (I2) I 14 11 7 2 616 7743</p>
59	<p>I2, I, I, I, I, (3) I 15 10 11 13 6 105 1324</p>	160	<p>I2, I, I, I, (5) I 16 9 15 4 57 721</p>
61	<p>I2, I, 2, 4, I, (2) I 17 8 5 16 7 928 11775</p>	162	<p>I2, I, 2, I, 2, (I2) I 18 7 14 9 2 1540 19601</p>
63	<p>I2, I, 3, 3, 2, I, I, 7, I, (II) I 19 6 7 9 11 14 3 21 2 5019135 64080026</p>	164	<p>I2, I, 4, (6) I 20 5 4 160 2049</p>
65	<p>I2, I, 5, (2) I 21 4 11 84 1079</p>	166	<p>I2, I, 7, I, I, I, 2, 4, I, 3, 2 (I2) I 22 3 15 10 13 9 5 17 6 11 2 132015642 1700902565</p>
67	<p>I2, I, (II) I 23 2 13 168</p>	168	<p>I2, (I) I 24 1 13</p>

169	13, (0) I 0 0 1	170	13, (26) I I 26 339
171	13, (13) I 2 13 170	172	13, 8, I, 2, 2, I, I, 3, (6) I 3 17 8 9 12 13 7 4 1848942 24248647
173	13, 6, (I, I) I 4 (13 13) 190060 2499849	174	13, 5, (4) I 5 6 110 1451
175	13, 4, 2, (I) I 6 9 14 153 2024	176	13, 3, (I) I 7 16 15 199
177	13, 3, 3, 2, (8) I 8 7 11 3 4692 62423	178	13, 2, I, (12) I 9 17 2 120 1601
179	13, 2, I, I, I, 3, 5, (13) I 10 13 11 14 7 5 2 313191 4190210	180	13, 2, (2) I 11 9 12 161
181	13, 2, 4, I, 8, 6, I, I, I, I, (2, 2) I 12 5 20 3 4 15 11 12 13 (9 9) 183567298683461940 2469645423824185801	182	13, (2) I 13 2 27
183	13, I, I, (8) I 14 13 3 36 487	184	13, I, I, 3, 2, I, (2) I 15 12 7 9 15 8 1794 24335

5	13, I, (I, I) I 16 (II II) 680 9249	186	13, I, I, I, 3, (4) I 17 10 15 7 6 550 7501
7	13, I, 2, (I3) I 18 9 2 123 1682	188	13, I, 2, 2, (6) I 19 8 11 4 336 4607
9	13, I, (2) I 20 7 4 55	190	13, I, 3, I, I, I, 2, (2) I 21 6 15 11 14 9 10 3774 52021
I	13, I, 4, I, I, 3, 2, 2 (I3) I 22 5 14 13 7 10 11 2 650783 8994000	192	13, I, (5) I 23 4 7 97
3	13, I, 8, 3, 2, I, (3, 3) I 24 3 8 9 16 (7 7) 448036604040 6224323426849	194	13, I, (12) I 25 2 14 195
5	13, (I) I 26 1 14	196	14, (0) I 0 0 1
7	14, (28) I I 28 393	198	14, (14) I 2 14 197
9	14, 9, 2, I, 2, 2, 5, 4, I, I, (I3) I 3 10 15 9 11 5 6 13 15 2 1153080099 16266196520	200	14, (7) I 4 7 99

201	14, 5, 1, 1, 1, 2, 1, (8) 1 5 16 11 15 8 19 3 36332 515095
202	14, 4, 1, (2, 2) 1 6 17 (9 9) 1388322 19731763
203	14, (4) 1 7 4 57
204	14, 3, 1, 1, (6) 1 8 13 15 4 350 4999
205	14, 3, 6, 1, (4) 1 9 4 21 5 2772 39689
206	14, 2, 1, 5, (14) 1 10 17 5 2 4148 59535
207	14, 2, 1, 1, (2) 1 11 13 14 9 80 1151
208	14, 2, 2, (1) 1 12 9 16 45 649

9	14, 2, 5, 3, (2) 1 13 5 8 11 3220 46551
10	14, (2) 1 14 2 29
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904 30, (15)
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30, 8, I, I, 2, 2, I, 19, 2, I, 2, 5, 9, I, 5, I, 3, I, 3, I, I, (29)

I 7 33 26 21 18 41 3 22 31 21 11 6 47 9 42 13 39 14 27 33 2

4111488857741309517

123823410343073497682

30, 7, I, I, (14)

I 8 29 31 4

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30, 6, I, 2, (6)

I 9 37 20 9

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30, 5, 2, 8, 5, I, 11, 4, 4, 2, I, I, (29)

I 11 26 7 10 47 5 14 13 22 25 35 2

12319363142953

371832584927520

30, (5)

I 12

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913

30, 4, I, I, I, 2, I, I, 6, 7, 2, 2, 19, I, 2, I, (4)
 I 13 33 24 31 19 27 32 9 8 23 24 3 43 16 39 11
 17068312251564
 515734243080407

914

30, 4, (3, 3)
 I 14 (17 17)
 2069410
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30, (4)
 I 15
 4
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30, 3, I, 3, 3, I, I, (14)
 I 16 37 15 16 27 33 4
 193230
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917

30, 3, I, I, 4, I, 14, 3, (8)
 I 17 28 31 11 47 4 19 7
 27197820
 823604599

918

30, 3, 2, I, 6, (30)
 I 18 19 38 9 2
 136010
 4120901

919

30, 3, 5, I, 2, I, 2, I, I, I, 2, 3, I, 19, 2, 3, I, I
 I 19 10 39 17 35 18 31 25 30 21 14 45 3 26 15 29 30
 { 4, 9, I, 7, I, 3, 6, 2, 11, I, I, I, (29)
 13 6 49 7 42 15 9 27 5 38 21 39 2
 147834442396537976684499589
 4481603010937119451551263720

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30, (3)
 I 20
 3
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21	30, 2, I, 6, I, II, 3, I, 2, 2, 3, I, I, I, I, 8, (20) I 21 37 8 49 5 16 35 19 23 15 32 25 29 24 35 7 3 83104627139412 2522057712835735
22	30, 2, I, 2, I, 9, 2, I, I, (6, 6) I 22 33 17 41 6 23 26 33 (9 9) 11579506138834350 351605368773852499
23	30, 2, I, (I) I 23 29 26 21 638
24	30, 2, I, I, (14) I 24 25 35 4 380 11551
25	30, 2, (2, 2) I 25 (21 21) 51156 1555849
26	30, 2, 3, II, I, 7, I, 3, 2, 5, I, I, I, 4, (30) I 26 17 5 50 7 43 14 25 10 35 23 34 13 2 10008472361032 304560297142335
27	30, 2, 4, 5, (3) I 27 13 11 18 7473 227528
28	30, 2, 6, 3, I, I, I, 8, (15) I 28 9 16 33 23 36 7 4 25229061 768555217

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30, 2, II, I, 2, 3, 1, 5, 2, I, 6, I, 14, 2, 1, (2, 2)
 I 29 5 40 19 16 40 10 20 38 8 50 4 22 32 (20 20)
 433896111669844912840 25, 8, 11 (23, 23)
 13224937103288377430049

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30, I, I, 19, I, 5, 6, I, I, I, I, (2)
 I 31 30 3 49 10 9 34 25 27 30 19
 218975640
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30, I, I, 8, 4, I, I, 2, I, I, I, (14)
 I 32 29 7 13 31 28 19 32 23 37 4
 35127652
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933

30, I, I, 5, (20)
 I 33 28 11 3
 2464
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934

30, I, I, 3, I, I, 3, (30)
 I 34 27 15 30 29 17 2
 99294
 3034565

935

30, I, I, 2, (1)
 I 35 26 19 34
 45
 1376

936

30, I, I, 2, (6)
 I 36 25 23 9
 170
 5201

929-936

30, I, I, I, I, 3, 4, 2, 3, 6, I, I, 19, I, 6, I, (2, 2)
 I 37 24 27 51 16 13 24 17 9 29 32 3 51 8 39 (19 19)
 15701968936415353889062192632
 480644425002415999597113107233

30, I, I, I, 2, (8)
 I 38 23 31 22 7
 560
 17151

30, I, I, I, 4, (20)
 I 39 22 35 13 5
 4004
 122695

30, I, I, I, (14)
 I 40 21 39 4
 138
 4231

30, I, 2, 11, I, 14, 2, 2, (I, I)
 I 41 20 5 53 4 25 20 (29 29)
 34845956052079180
 1068924905989944201

30, I, 2, 4, (20)
 I 42 19 14 3
 3458
 106133

30, I, 2, (2)
 I 43 18 23
 24
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30, I, 2, I, I, I, 2, 2, (3)
 I 44 17 32 25 31 20 23 16
 18285
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30, I, 2, I, 6, (12)

I 45 16 41 9 5

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30, I, 3, 8, I, I, 6, 3, 3, I, 3, I, I, I, 2, (30)

I 46 15 7 31 30 9 18 15 39 14 33 25 30 23 2

1470417148788

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30, I, 3, 2, 2, 2, I, 4, I, 7, I, (29)

I 47 14 23 22 19 38 11 46 7 53 2

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30, I, 3, I, 3, (20)

I 48 13 39 16 3

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30, I, 4, 6, I, I, I, 4, 2, 14, I, 19, I, (I, I)

I 49 12 9 36 23 35 12 27 4 55 3 36 (25 25)

19789181711517243033171740

609622436806639069525576201

950

30, I, 4, I, I, I, I, I, (2)

I 50 11 34 25 29 26 31 19

6570

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951

30, I, 5, 5, 2, 3, I, I, I, (9)

I 51 10 11 25 15 34 23 37 6

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952

30, I, 5, I, (6)

I 52 9 47 8

378

11663

953

30, I, 6, I, 2, I, 3, 8, I, I, (4, 4)
 I 53 8 41 17 37 16 7 32 29 (13 13)

488830275367615376

15090531843660371073

954

30, I, 7, I, 5, 3, 2, (6)
 I 54 7 47 10 17 25 9

1038630

32080051

955

30, I, 9, 3, 6, I, I, 5, (12)
 I 55 6 19 9 31 30 11 5

67800900

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956

30, I, II, 2, I, I, I, I, 7, 8, I, 2, 2, I, 2, I, (14)
 I 56 5 23 29 28 25 35 8 7 40 19 20 35 17 43 4

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957

30, I, I4, (2)
 I 57 4 29

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958

30, I, I9, I, I, I, 6, 4, I, I, I, I, 2, I, 4, I, 9, 2, (30)
 I 58 3 39 22 37 9 13 33 26 27 31 18 39 11 47 6 29 2

541572514048560

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30, I, (29)
 I 59 2

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961	3I, (o) I o 0 1
962	3I, (62) I I 62 1923
963	3I, (3I) I 2 31 962
964	3I, 20, I, 2, 6, I, I, 3, I, I, I, II, I, 4, 3, I, (I4) I 3 4I 20 9 32 29 15 32 27 25 36 5 47 12 15 45 4 324820602522300 10085143557001249
965	3I, 15, (I, I) I 4 (3I 3I) 14374204 446526729
966	3I, 12, 2, (2) I 5 25 2I 1850 57499
967	3I, 10, 2, I, 6, 4, 3, 2, 2, I, I, 8, 3, 2, I, 20, (3I) I 6 2I 38 9 14 17 23 2I 27 34 7 18 19 42 3 2 149518887194649693 4649532557817485528
968	3I, 8, I, (6) I 7 49 8 630 19601

969 3I, 7, I, 3, 3, I, I, I, (2)
 I 8 43 15 16 33 25 32 19
 436540
 13588951

970 3I, 6, I, 9, (I, I)
 I 9 49 6 (3I 3I)
 6915917802
 215395035859

971 3I, 6, 4, I, I, I, 2, 5, 3, 2, 10, (3I)
 I 10 13 34 25 31 22 11 17 26 5 2
 400496058813
 12479806786330

972 3I, 5, I, I, I, 7, 6, I, 3, I, (14)
 I 11 36 23 37 8 9 44 13 47 4
 316368130
 9863382151

973 3I, 5, 5, 2, (8)
 I 12 11 27 7
 28956
 903223

974 3I, 4, I, 3, I, I, I, II, I, 5, 3, 8, I, I, I, I, (30)
 I 13 41 14 35 23 38 5 49 10 19 7 35 26 25 37 2
 15662987185124
 488825745235215

975 3I, 4, (2)
 I 14 25
 40
 1249

976 3I, 4, 6, I, 2, 3, I, 4, 2, (3)
 I 15 9 39 20 15 41 12 25 16
 56538495
 1766319049

977

3I, 3, I, 8, 5, I, I, 3, 7, (I, I)
 I 16 43 7 II 32 29 17 8 (3I 3I)
 3481871275306470280
 108832847723078562849

978

3I, 3, I, I, I, (30)
 I 17 34 23 39 2
 3784
 118337

979

3I, 3, 2, 5, I, (4)
 I 18 25 10 45 II
 11520
 360449

980

3I, 3, 3, I, I, (2)
 I 19 16 3I 29 20
 1656
 51841

981

3I, 3, 8, I, I, I, I, I, I, 2, I, I, 15, 12, 2, (6)
 I 20 7 36 25 29 28 27 3I 20 27 35 4 5 28 9
 5046808151700
 158070671986249

982

3I, 2, I, (30)
 I 2I 4I 2
 282
 8837

983

3I, 2, I, 5, (3I)
 I 22 37 II 2
 9061
 284088

984

3I, 2, I, 2, 2, (7)
 I 23 33 20 25 8
 2831
 88805

85

3I, 2, (1, 1)
I 24 (29 29)

10608

332929

86

3I, (2, 2)
I (25 25)

1570

49299

87

3I, 2, (2)
I 26 21

12

377

88

3I, 2, 3, 4, I, 20, 6, I, (14)
I 27 17 12 49 3 9 51 4

462879684

14549450527

89

3I, 2, 4, 2, I, II, I, 8, 15, I, I, I, I, 2, I, 2, (2)
I 28 13 20 41 5 52 7 4 37 25 28 31 19 35 20 23

17497618534396

550271588560695

90

3I, 2, (6)
I 29 9

28

881

91

3I, 2, 12, 10, 2, 2, 2, I, I, 2, 6, I, I, I, I, 3, I, 8,
I 30 5 6 25 22 21 30 29 23 9 35 26 27 33 14 45 7

{ 4, I, 2, I, 2, 3, I, 4, I, 20, 6, 4, (3I)
13 39 18 35 21 15 42 11 50 3 10 15 2

12055735790331359447442538767

379516400906811930638014896080

92

3I, (2)
I 31

2

63

993	3I, I, I, (20) I 32 31 3 84 2647
994	3I, I, I, (8) I 33 30 7 36 1135
995	3I, I, I, 5, 4, 3, (12) I 34 29 11 14 19 5 280120 8835999
996	3I, I, I, 3, I, 2, 2, I, I, I, (4) I 35 28 15 37 20 21 32 25 35 12 271038 8553815
997	3I, I, I, 2, I, 4, (I, I) I 36 27 19 39 12 (31 31) 456624468 14418057673
998	3I, I, I, 2, 4, 8, I, 3, I, (30) I 37 26 23 14 7 26 13 49 2 31150410 984076901
999	3I, I, I, I, I, 5, 6, I, 5, (2) I 38 25 27 34 11 9 47 10 27 3248924 102688615
1000	3I, I, I, I, I, I, 6, 2, 2, (15) I 39 24 31 25 36 9 24 25 4 1248483 39480499

TABULA II.

SOLUTIONEM AEQUATIONIS

$$y^2 - ax^2 + 1 = 0$$

QUOTIESCUNQUE VALOR IPSIUS a
TALEM ADMISERIT,

EXHIBENS.

but $a = \beta^2 + 1$ where obviously
 $y = \beta, x = 1$ is not contained in the
table

NOTA. Sequentis tabulæ cum præcedente collatio monstrabit,
hic non nisi eos ipsius α valores occurrere, qui in tab.
I. sibi respondentes habeant series gemino numero unci-
nulis incluso terminatas.

13	5 18	29	13 70
41	5 32	53	25 182
58	13 99	61	3805 29718
73	125 1068	74	5 43
85	41 378	89	53 500
97	569 5604	106	389 4005
109	851525 8890182	113	73 776
125	61 682	130	5 57
137	149 1744	149	9305 113582
157	385645 4832118	173	85 1118
181	82596761 1111225770	185	5 68
193	126985 1764132	202	221 3141
218	17 251	229	113 1710
233	1517 23156	241	4574225 71011068
250	281 4443	265	373 6072
269	5 82	274	85 1407

277	535979945 8920484118	281	63445 1063532
293	145 2482	298	23725 409557
313	7170685 126862368	314	25 443
317	19805 352618	337	55335641 1015827336
338	13 239	346	5 93
349	493 9210	353	3793 71264
365	181 3458	370	17 327
373	265 5118	389	65 1282
394	19900973 395023035	397	1027776565 20478302982
409	5534176685 111921796968	421	2146497463530785 44042445696821418
425	13 268	433	347483377 7230660684
445	221 4662	449	8941705 189471332
457	2764111349 59089951584	458	5 107
461	1132421 24314110	481	43961 964140
493	30805 683982	509	17540333 395727950
521	5624309 128377240	533	265 6118

38	2977 69051	541	58536158470221584 1361516316469227450
54	7405 174293	557	5 118
55	620633 14752278	569	121359005 2894863832
36	169992665 4115086707	593	24665 600632
01	5689030769845 139468303679532	610	2909 71847
3	19454612624065 481673579088618	617	1650989 41009716
29	313 7850	634	2621173333 65999458125
11	1426687145 36120833468	653	89664965 2291286382
31	111453260296346905 2865454435422583218	673	1881620424025 48813455293932
35	8353189 218623878	697	5 132
08	193 5099	701	445 11782
09	685217 18245310	733	365 9882
46	202645 5534843	754	745 20457
57	49769 1369326	761	29 800
59	590222604844777 16367374077549540	773	48305 1343018
78	1957873 54610269	794	1073 30235

797	875485 24715982	809	15253424933 433852026040
818	5 143	821	74038651465 2121436703918
829	537965 15489282	845	421 12238
853	355375843945 10379165085018	857	277325 8118568
865	11844089 348345108	877	8149 241326
881	3581882825 106316171432	914	185 5593
922	13808525 419288307	925	29 882
929	2667927065 81317086468	937	16015008052621 490226695010796
941	23832181 731069390	949	566738044393 17458843558590
953	88979677 2746864744	965	481 14942
970	10537 328173	977	236003105 7376748868
985	13 408	986	5 157
997	2689 84906		

797-997

ERRATA. Tab. I. pag. 17. apud $\alpha = 238$ pro α lege 756

F I N I S.



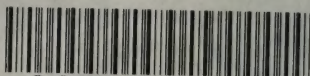
SEP 21 '51

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